## CLAIMS

What is claimed is:

1. A digital predistortion circuit for compensating nonlinear distortion introduced by analog-transmitter components of a digital communications transmitter, said predistortion circuit comprising:

a source of a complex-forward-data stream configured to digitally convey information;

a basis-function generator coupled to said complex-forward-data-stream source and configured to generate a complex-basis-function-data stream in response to said complex-forward-data stream;

a filter coupled to said basis-function generator and configured to generate a complex-filtered-basis-function-data stream in response to said complex-basis-function-data stream; and

a combination circuit for combining said complex-filtered-basis-function-data stream and said complex-forward-data stream to compensate for said nonlinear distortion.

2. A predistortion circuit as claimed in claim 1 wherein said filter is an equalizer defined by filter coefficients.

3. A predistortion circuit as claimed in claim 2 additionally comprising a feedback section adapted to receive a feedback signal from said analog-transmitter components and to generate a return-data stream, said feedback section being coupled to said equalizer so that said filter coefficients are responsive to said return-data stream.

4. A predistortion circuit as claimed in claim 3 wherein:

said complex-forward-data stream exhibits a forward resolution; and

said return-data stream exhibits a return resolution less than said forward resolution.

5. A predistortion circuit as claimed in claim 3 additionally comprising a programmable delay element coupled between said basis-function generator and said feedback section, said programmable delay element being configured to produce a delayed-complex-forward-data stream temporally aligned with said return-data stream.

6. A predistortion circuit as claimed in claim 3 wherein:

said equalizer implements an estimation-and-convergence algorithm to determine said filter coefficients;

said estimation-and-convergence algorithm is responsive to said complex-basis-function-data stream and to said return-data stream;

said complex-forward-data stream and said return-data stream exhibit forward-error and return-error levels, respectively, with said return-error level being greater than said forward-error level; and

said estimation-and-convergence algorithm is configured to transform increased algorithmic processing time into reduced effective-error level for said return-data stream.

7. A predistortion circuit as claimed in claim 2 wherein said equalizer implements an estimation-and-convergence algorithm to determine said filter coefficients.

8. A predistortion circuit as claimed in claim 2 wherein:

said equalizer is a non-adaptive equalizer configured to be programmed with said filter coefficients; and

said predistortion circuit additionally comprises an adaptation engine selectively coupled to said non-adaptive equalizer and configured to implement an estimation-and-convergence algorithm which determines said filter coefficients.

9. A predistortion circuit as claimed in claim 8 additionally comprising a controller coupled to said non-adaptive equalizer and to said adaptation engine, said controller being configured to couple said adaptation engine to said non-adaptive equalizer to determine said filter coefficients and to decouple said adaptation engine from said non-adaptive equalizer.

10. A predistortion circuit as claimed in claim 8 wherein:

said non-adaptive equalizer is a complex equalizer having an in-phase path, a quadrature path, an in-phase-to-quadrature path, and a quadrature-to-in-phase path;

a first set of said filter coefficients is programmed in said in-phase and quadrature paths, and a second set of said filter coefficients is programmed in said in-phase-to-quadrature and quadrature-to-in-phase paths; and

said adaptation engine accommodates a partial complex equalizer and has first and second paths, said first and second paths being configured in one mode to determine said filter coefficients for said in-phase and quadrature paths, and being configured in another mode to determine said filter coefficients for said in-phase-to-quadrature and quadrature-to-in-phase paths.

11. A predistortion circuit as claimed in claim 1 wherein said complex-basis-function-data stream is responsive to $X(n)^{\bullet}|X(n)|^{K}$, where $X(n)$ represents said complex-forward-data stream, and K is an integer greater than or equal to one.

12. A predistortion circuit as claimed in claim 1 wherein said basis-function generator generates a plurality of complex-basis-function-data streams.

13. A predistortion circuit as claimed in claim 12 wherein:

said filter is a first equalizer that processes a first one of said plurality of complex-basis-function-data streams;

one or more additional equalizers respectively process other ones of said plurality of complex-basis-function-data streams; and

said first equalizer and said one or more additional equalizers couple to said combination circuit.

14. A predistortion circuit as claimed in claim 13 wherein:

said first equalizer and said one or more additional equalizers are non-adaptive equalizers; and

said predistortion circuit additionally comprises an adaptation engine selectively coupled to said non-adaptive equalizers, said adaptation engine being configured to implement an estimation-and-convergence algorithm which determines filter coefficients for said non-adaptive equalizers.

15. A predistortion circuit as claimed in claim 14 wherein:

each of said non-adaptive equalizers is a complex equalizer having an in-phase path, a quadrature path, an in-phase-to-quadrature path, and a quadrature-to-in-phase path;

for each of said non-adaptive equalizers, a first set of said filter coefficients is programmed in said in-phase and quadrature paths, and a second set of said filter coefficients is programmed in said in-phase-to-quadrature and quadrature-to-in-phase paths; and

said adaptation engine accommodates a partial complex equalizer and has first and second paths, said first and second paths being configured in one mode to determine filter coefficients for said in-phase and quadrature paths, and being configured in another mode to determine said filter coefficients for said in-phase-to-quadrature and quadrature-to-in-phase paths.

16. A predistortion circuit as claimed in claim 1 wherein:

said basis-function generator is configured to generate a plurality of substantially orthogonal basis functions;

each of said basis functions is responsive to $X(n)^{\bullet}|X(n)|^{K}$, where $X(n)$ represents said complex-forward-data stream and K is an integer greater than or equal to one; and

each of said basis functions produces a complex-basis-function-data stream.

17. A predistortion circuit as claimed in claim 1 wherein:

said predistortion circuit additionally comprises a heat estimator adapted to receive a signal responsive to said

complex-forward-data stream and to generate a heat signal responsive to relative power in said complex-forward-data stream; and

said heat estimator couples to said filter so that said heat signal influences said complex-filtered-basis-function-data stream.

18. A predistortion circuit as claimed in claim 17 wherein said filter is an adaptive equalizer that is responsive to said heat signal.

19. A predistortion circuit as claimed in claim 18 wherein said adaptive equalizer is configured to maximally correlate change in filter coefficients with change in power exhibited by said complex-forward-data stream.

20. A predistortion circuit as claimed in claim 17 wherein said heat estimator is configured so that said heat signal is responsive to instantaneous changes in power of said complex-forward-data stream relative to an average power of said complex-forward-data stream over time.

21. A digital predistortion circuit for compensating nonlinear distortion introduced by analog-transmitter components of a digital communications transmitter, said predistortion circuit comprising:

a source of a forward-data stream configured to digitally convey information;

a basis-function generator coupled to said source and configured to generate a basis-function-data stream in response to said forward-data stream;

a heat estimator adapted to receive a signal responsive to said forward-data stream and to generate a heat signal responsive to power of said forward-data stream;

a digital equalizer section coupled to said basis-function generator and to said heat estimator, said equalizer section being configured to generate a filtered-basis-function-data stream in response to said basis-function-data stream and said heat signal; and

a combination circuit for combining said filtered-basis-function-data stream and said forward-data stream to compensate for said nonlinear distortion.

22. A predistortion circuit as claimed in claim 21 wherein said equalizer section includes an adaptive equalizer that is responsive to said heat signal.

23. A predistortion circuit as claimed in claim 22 wherein:

said adaptive equalizer determines filter coefficients so that said basis-function-data stream is filtered into said filtered-basis-function-data stream in response to said filter coefficients; and

said adaptive equalizer is configured to maximally correlate changes in said filter coefficients with changes in magnitude exhibited by said complex-forward-data stream.

24. A predistortion circuit as claimed in claim 23 wherein said adaptive equalizer is configured to determine heat-sensitivity coefficients which, when multiplied by said heat signal, cause said heat signal to maximally correlate with said changes in said filter coefficients.

25. A predistortion circuit as claimed in claim 23 wherein said changes in said filter coefficients are determined in response to average filter coefficient values determined over a preceding duration.

26. A predistortion circuit as claimed in claim 21 wherein said heat estimator is configured so that said heat signal is responsive to instantaneous changes in magnitude of said forward-data stream relative to an average magnitude of said forward-data stream over time.

27. A predistortion circuit as claimed in claim 21 wherein:

said equalizer section includes an adaptive equalizer that generates filter coefficients and is responsive to said heat signal;

said adaptive equalizer is configured to generate a filter-coefficient-change signal responsive to changes in said filter coefficients; and

said heat estimator is configured to delay said heat signal into temporal alignment with said filter-coefficient-change signal.

28. A predistortion circuit as claimed in claim 21 additionally comprising a feedback section adapted to receive a feedback signal from said analog-transmitter components and to generate a return-data stream, said feedback section being coupled to said equalizer section so that filter coefficients are responsive to said return-data stream and to said heat signal.

29. A predistortion circuit as claimed in claim 28 wherein:

said forward-data stream exhibits a forward resolution; and

said return-data stream exhibits a return resolution less than said forward resolution.

30. A predistortion circuit as claimed in claim 21 wherein said basis-function generator generates a plurality of basis-function-data streams.

31. A predistortion circuit as claimed in claim 30 wherein:

said equalizer section includes a plurality of equalizers;

a first one of said plurality of equalizers processes a first one of said plurality of basis-function-data streams;

one or more additional ones of said plurality of equalizers respectively process other ones of said plurality of basis-function-data streams; and

said first equalizer and said one or more additional equalizers couple to said combination circuit.

32. A predistortion circuit as claimed in claim 31 wherein:

said first equalizer and said one or more additional equalizers are non-adaptive equalizers; and

said equalizer section additionally comprises an adaptation engine coupled to each of said non-adaptive equalizers, said adaptation engine being configured to implement an estimation-and-convergence algorithm which determines filter coefficients for said non-adaptive equalizers.

33. A predistortion circuit as claimed in claim 21 wherein:

said forward-data stream is a complex data stream;

said basis-function generator is configured to generate a plurality of basis functions;

each of said basis functions is responsive to $X(n) \bullet |X(n)|^K$, where $X(n)$ represents said forward-data stream and $K$ is an integer greater than or equal to one; and

each of said basis functions produces a complex-basis-function-data stream.

34. A method of digitally compensating for nonlinear distortion introduced by analog-transmitter components of a digital communications transmitter, said method comprising:

providing a forward-data stream configured to digitally convey information;

generating a basis-function-data stream responsive to $X(n)^{\bullet}|X(n)|^{K}$, where X(n) represents said forward-data stream, and K is an integer greater than or equal to one;

filtering said basis-function-data stream to generate a filtered-basis-function-data stream; and

combining said filtered-basis-function-data stream and said forward-data stream to compensate for said nonlinear distortion.

35. A method as claimed in claim 34 wherein said filtering activity filters said basis-function-data stream in a manner determined by filter coefficients, and said method additionally comprises:

down-converting a feedback signal obtained from said analog-transmitter components to generate a return-data stream; and

processing said return-data stream to generate said filter coefficients.

36. A method as claimed in claim 35 wherein:

said return-data stream exhibits a lower resolution than is exhibited by said forward-data stream; and

said return-data stream exhibits a lower resolution than is exhibited by said basis-function-data stream.

37. A method as claimed in claim 34 wherein said filtering activity filters said basis-function-data stream in

response to filter coefficients, and said method additionally comprises:

generating a heat signal in response to said forward-data stream; and

adjusting said filter coefficients in response to said heat signal.

38. A method as claimed in claim 37 wherein said heat-signal-generating activity is configured so that said heat signal is responsive to instantaneous changes in power of said forward-data stream relative to an average power of said forward-data stream over time.

39. A method as claimed in claim 34 wherein said filtering activity filters said basis-function-data stream in response to filter coefficients, and said method additionally comprises:

down-converting a feedback signal obtained from said analog-transmitter components to generate a return-data stream;

processing said forward-data stream and said return-data stream to generate said filter coefficients;

generating a heat signal in response to said forward-data stream; and

processing said filter coefficients and said heat signal to generate heat-sensitivity coefficients; and

adjusting said filter coefficients in response to said heat signal and said heat-sensitivity coefficients.

40. A method as claimed in claim 39 wherein each of said processing activities comprises implementing an estimation-and-convergence algorithm.

41. A method as claimed in claim 34 wherein:

said filtering activity filters said basis-function-data stream in response to filter coefficients;

said filtering activity is performed by a programmable digital equalizer section which includes a non-adaptive equalizer selectively coupled to an adaptation engine; and

said method additionally comprises coupling said adaptation engine to said non-adaptive equalizer to determine said filter coefficients, then decoupling said adaptation engine from said non-adaptive equalizer.

42. A method as claimed in claim 41 wherein:

each of said forward-data stream, said basis-function-data stream, and said filtered-basis-function-data stream is a complex-data stream;

said non-adaptive equalizer is a complex equalizer having first and second sets of filter coefficients;

said adaptation engine accommodates a partial complex equalizer; and

as a result of said coupling activity, said adaptation engine identifies said first set of filter coefficients, then after identifying said first set of filter coefficients identifies said second set of filter coefficients.

43. A method as claimed in claim 34 wherein:

said generating activity generates a plurality of basis functions, with each of said basis functions being responsive to $X(n)^{\bullet}|X(n)|^{K}$, where $X(n)$ represents said forward-data stream and $K$ is an integer greater than or equal to one, and with each of said basis functions producing its own basis-function-data stream;

said filtering activity filters each of said plurality of basis-function-data streams to generate a corresponding plurality of filtered-basis-function-data streams; and

said combining activity combines said plurality of filtered-basis-function-data streams with said forward-data stream to compensate for said nonlinear distortion.

44. A method as claimed in claim 43 wherein, for each of said plurality of basis-function-data streams, said filtering activity filters said basis-function-data stream in a manner determined by a filter-coefficient set configured for said basis-function-data stream, and said method additionally comprises:

down-converting a feedback signal obtained from said analog-transmitter components to generate a return-data stream; and

processing said return-data stream to sequentially generate said filter-coefficient sets.

45. A method as claimed in claim 44 wherein:

said filtering activity is performed by a digital equalizer section which includes a plurality of non-adaptive equalizers and an adaptation engine; and

said method additionally comprises sequentially coupling said adaptation engine to each of said non-adaptive equalizers so that said adaptation engine will converge upon one of said filter-coefficient sets, then programming said one of said filter-coefficient sets into a corresponding one of said non-adaptive equalizers, and decoupling said adaptation engine from said corresponding one of said non-adaptive equalizers.